

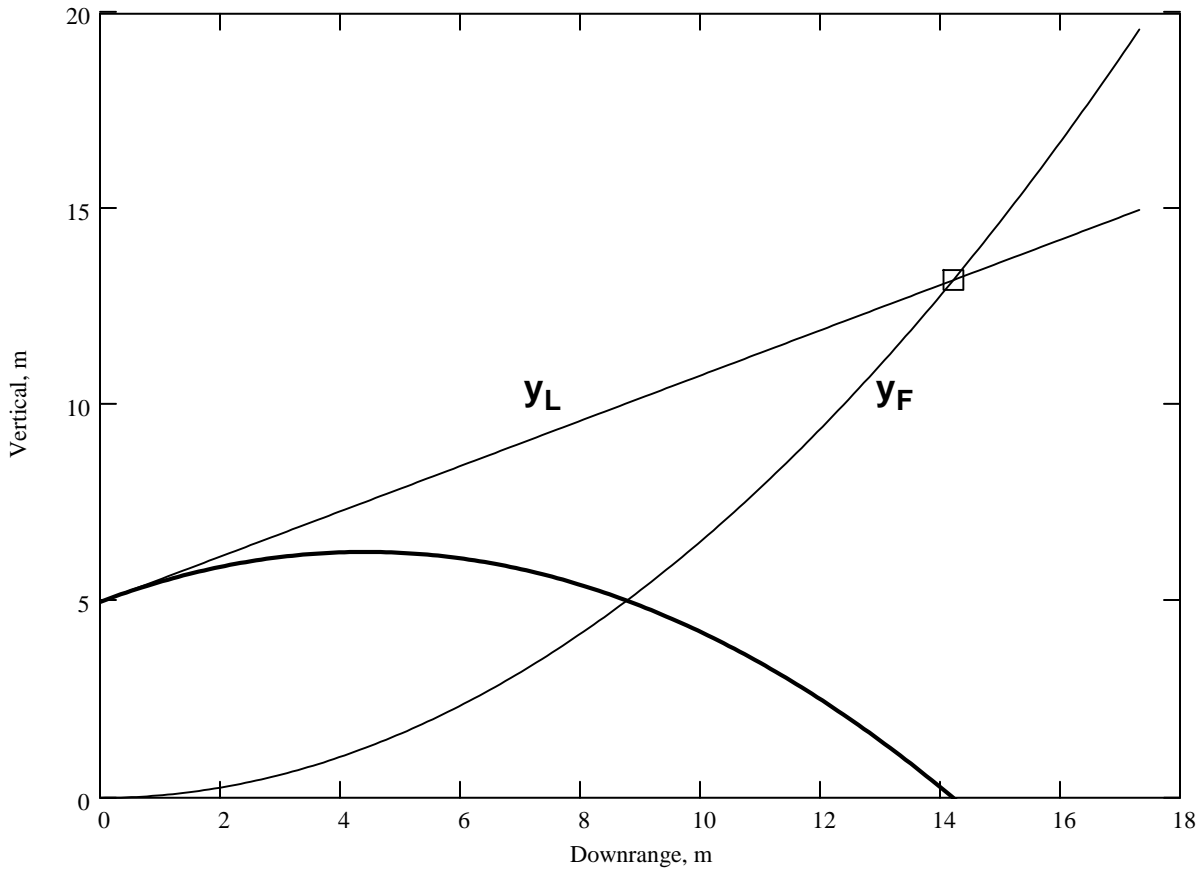
PROJECTILE MOTION

Free fall below line

We can consider the motion of the projectile as the superposition of two motions: one along a straight line, based on the initial velocity and angle, and another motion consisting of a free fall from that line.

$$y_L(t) := v_0 \sin(\theta) t + y_0 \quad y_F(t) := \frac{1}{2} g t^2 \quad x(t) := v_0 \cos(\theta) t$$

$$T := \frac{1}{g} \left[v_0 \sin(\theta) + \sqrt{(v_0 \sin(\theta))^2 + 2 g y_0} \right]$$



Initial velocity 10 m / s, angle 30 degrees.

The straight line is the no-gravity trajectory. The upward-curved line is the distance fallen by the projectile during the flight. The thick line is the trajectory resulting from subtracting the distance fallen from the straight line, i.e., the parabolic trajectory. Note that the curved line intersects the straight line at the range, that is, at the end of the flight, when the net y displacement is zero. The square indicates the predicted time of flight, using the T equation above, developed elsewhere in this series.